REMARKS

The final Office Action dated October 1, 2010 has been received and its contents carefully noted. The Office examined claims 1-30. Claims 1-26 and 30 are rejected; claim 27-29 are objected to. With this paper, claim 30 is canceled and claim 23 is amended.

The features of claim 30 have been incorporated into amended claim 23; claim 30 has been canceled. No new matter has been introduced by way of amendment.

Claim Rejections under 35 USC §103

At pages 2-9 of the Office Action, claims 1, 5-11, 17, 20 and 22 are rejected under 35 USC §103(a) as being unpatentable over Richards et al. (US 6,950,485, hereinafter Richards) in view of Roberts (US 2006/0166619). Of these, claims 1 and 17 are independent.

With regard to independent claim 1, applicant submits that Richards in view of Roberts fails to teach every feature of the claimed invention, namely "... a first encoding step on the part of the transmitter, in which a pulse group, which is formed from a predetermined number of individual pulses in such a way that the individual pulses of said pulse group partially overlap in respect of time after the pulse forming operation, is encoded in dependence on values of a random number sequence...".

The Office essentially argues that Roberts discloses encoding of a pulse group, which has been formed in such a way that individual pulses of said pulse group partially overlap in respect of time. Applicant respectfully submits that this assessment is not accurate. Roberts teaches in paragraphs [0029] - [0044] a pulse position modulation technique known from the prior art. Within such pulse position modulation technique, one single pulse per modulation period is generated, wherein the pulse width of the pulses do usually not vary, but only the position of the pulse within in the modulation period is modulated (See para. [0029], "...by advancing or delaying individual pulses in time relative to uniform reference positions").

The general pulse position modulation technique works as follows: the position of the single pulse per modulation period is defined by the phase of the single pulse, that is, the time, when the rising edge of a pulse occurs. The phase angle is a value between 0 and 360°. For instance, the pulse of a first modulation period has a phase angle of 120° (rising edge occurs at t = T/3, T = modulation period) and a falling edge somewhere after t

= T/3 and before the end of the modulation period @ t = T. The pulse of the second modulation period has, for instance, a phase of 240° (rising edge occurs @ t = T + 2*T/3). The phase difference between the phase of the pulse of the first modulation period and the phase of the pulse of the second modulation period is used for encoding/decoding information. In particular, in order to encode/decode the information, the phase of the pulse of the antecedent or, respectively, successive modulation period must be known.

Roberts teaches the same by introducing so-called constellation diagrams in paragraphs [0030] – [0034] and in figures 5A-5C, as it is common for illustrating pulse position modulation, as the Wikipedia article located at http://en.wikipedia.org/wiki/Constellation_diagram confirms (copy attached as Appendix A). Each of the three figures 5A – 5C show two pulses: the first pulse of a uniform reference position (1,0) of a first modulation period and a second pulse at position (., 1. . 2) of a second modulation period, which follows after the first modulation period. According to the Wikipedia article, the constellation diagrams are standard I-Q-diagrams, which show possible pulse positions of a pulse within one single modulation period. The symbol points thus indicate a possible phase of a single pulse in one modulation period. As [0033] - [0034] of Roberts disclose, the distance between two symbol points (that is, the phase difference between the pulse of a first modulation period and a pulse of a second modulation period) indicates the correlation between the two pulses. In one modulation period, however, there is only one single pulse. Therefore, the pulses cannot overlap with respect to time. The symbol points in the constellation diagram thus show possible pulse positions. The constellation diagrams do not indicate that every pulse position depicted with a symbol point actually occurs in one modulation period.

Let us consider the following example: if the modulation period is 100 ns, then the first modulation period occurs from t = 0...100 ns and second modulation period from t = 100...200 ns. The pulse of the first modulation period has, according to Figs. 5A – 5B of Roberts, a raising edge at t1R=0 ns and a falling edge, for instance, at t1F=30 ns.

If Roberts were referring to "a pulse overlap" in para. [0034], he indicates that the pulse in the second modulation period has a raising edge in the first 30 ns of the second modulation period, so for instance a raising edge at t2R=120 ns and a falling edge at t2F=150 ns.

If Roberts were referring to "no pulse overlap" in para. [0033], he indicates that the raising edge of the pulse of the second modulation does not occur between the first 30 ns, but after the first 30 ns, for instance the raising edge of the pulse the second modulation period occurs at t2R=140 ns and the falling edge at t2F=170 ns. If there were such overlap, the correlation of the two pulses would be high, and if there were no such overlap, the correlation would be low.

However, Roberts does not disclose two pulses of a single modulation period that occur at least partially simultaneously. In particular, Roberts does <u>not</u> disclose that a pulse group is formed in such a way that the individual pulses of said pulse group partially overlap in respect to time after the pulse forming operation, as claimed. Roberts does <u>not</u> disclose that such pulse group is encoded, as claimed. Figs. 5A – 5C of Roberts each show pulses that are already encoded.

This interpretation of Roberts presented above is also confirmed by para. [0036] of Roberts. This paragraph talks of "advanced and delayed pulses", which have been defined in equation [4] and thus are pulses, which are advanced/delayed in respect to a respective antecedent pulse, cf. equation (4).

The interpretation presented above is also confirmed by para. [0040] - [0044] of Roberts. These paragraphs generally describe a decomposition of a pulse position modulated pulse train and elaborate that a pulse of a modulation period comprises and unmodulated component, which eventually leads to an inefficient modulation (See para. [0044] of Roberts).

To arrive at this finding, a mathematical analysis of a single pulse is presented in the paragraphs listed above: a single pulse of a single modulation period can be mathematically expressed by two pulses, which are given in equation [6] of para. [0040] of Roberts ("...we define two new pulses..."). Para. [0042] of Roberts clearly states, that within one modulation period, only one single pulse is sent: "using this decomposition, we see that data bits are transmitted by sending either [m(t)+b(t)] or [m(t)-b(t)] at each time interval t=kT". Therefore, paragraphs [0040] - [0044] of Roberts also fail to disclose that a pulse group is formed in such a way that the individual pulses of said pulse group partially overlap in respect of time after the pulse forming operation, as claimed. According to paragraphs [0040] - [0044] of Roberts, two pulses do not occur at least partially

simultaneously, but only one single pulse remains in a single modulation period after pulse generation.

As argued in our response to previous Office Action, Richards also fails to disclose or suggest the features that are lacking in Roberts (said previous argument with regard to Richards is incorporated herein by reference). Accordingly, at least in view of the above, applicant respectfully submits that claim 1 is not anticipated by Roberts nor Richards, taken singly or in combination. Independent claim 17 recites similar features as claim 1 and is rejected for the same reasons as claim 1. For at least the reasons provided above with regard to claim 1, applicant respectfully requests that the rejection of claims 1 and 17 under 35 USC §103(a) be reconsidered and withdrawn.

Claims 5-11, 20 and 22 ultimately depend from claims 1 and 17 and recite additional features not recited in claims 1 and 17. As discussed above, Roberts and Richards fail to disclose or suggest every feature of the independent claims, e.g. "... a first encoding step on the part of the transmitter, in which a pulse group, which is formed from a predetermined number of individual pulses in such a way that the individual pulses of said pulse group partially overlap in respect of time after the pulse forming operation, is encoded in dependence on values of a random number sequence...". For at least the reasons provided above with regard to claims 1 and 17, applicant respectfully requests that the rejection of claims 5-11, 20 and 22 under 35 USC §103(a) be reconsidered and withdrawn.

Claim Rejections under 35 USC §102

At pages 13-14 of the Office Action, claims 23 and 25 are rejected under 35 USC §102(b) as being anticipated by Richards et al. (US Patent 6,950,485, hereinafter Richards). Of these, only claim 23 is independent.

Claim 23 has been amended to include the features of claim 30; claim 30 is subsequently canceled. No new matter has been introduced by way of amendment.

To the extent that the novelty rejection might be applied to the claims, as amended, it is respectfully traversed for the following reasons.

As amended, independent claim 23 includes the feature "...wherein the control unit is additionally adapted to control the pulse generator and the first encoding unit to form the coded pulse group from a predetermined plurality of single pulses in dependence on the values of the random number sequence in such a way that the single pulses of one and the same pulse group overlap in time after the pulse formation." This feature is similar to the feature of independent claims 1 and 17 that applicant discusses above to be lacking in Roberts and Richards.

Applicant respectfully submits that Richards fails to disclose or suggest this feature of the claimed invention. The Office further confirms this by not including claim 30 in its novelty rejection (nor similarly claims 1 and 17). Applicant respectfully submits that claim 23, as amended, is not anticipated by Richards and respectfully requests that the rejection of claim 23 under 35 USC §102(b) be reconsidered and withdrawn.

Claim 25 depends from claim 23 and recites additional features not recited in claim 23. For at least the reasons provided above with regard to claim 23, applicant respectfully requests that the rejection of claim 25 under 35 USC §102(b) be reconsidered and withdrawn.

Further Claim Rejections under 35 USC §103

At pages 14-15 of the Office Action, claim 24 is rejected under 35 USC §103(a) as being unpatentable over Richards et al. (US 6,950,485, hereinafter Richards) as applied to claim 23.

As discussed above, Richards fails to disclose or suggest all of the features of claim 23, namely "...wherein the control unit is additionally adapted to control the pulse generator and the first encoding unit to form the coded pulse group from a predetermined plurality of single pulses in dependence on the values of the random number sequence in such a way that the single pulses of one and the same pulse group overlap in time after the pulse formation," as amended. Claim 24 depends from claim 23 and recites additional features not recited in claim 23. For at least the reasons provided above with regard to claim 23, applicant respectfully requests that the rejection of claim 24 under 35 USC §103(a) be reconsidered and withdrawn.

At pages 15-16 of the Office Action, claim 26 is rejected under 35 USC §103(a) as being unpatentable over Richards et al. (US 6,950,485, hereinafter Richards) as applied to claim 23 in view of Chan (US 6,925,130).

As discussed above, Richards fails to disclose or suggest all of the features of claim 23, namely "...wherein the control unit is additionally adapted to control the pulse generator and the first encoding unit to form the coded pulse group from a predetermined plurality of single pulses in dependence on the values of the random number sequence in such a way that the single pulses of one and the same pulse group overlap in time after the pulse formation," as amended. Chan fails to disclose or suggest the features that are lacking in Richards. Claim 26 depends from claim 23 and recites additional features not recited in claim 23. For at least the reasons provided above with regard to claim 23, applicant respectfully requests that the rejection of claim 26 under 35 USC §103(a) be reconsidered and withdrawn.

At pages 16-17 of the Office Action, claim 30 is rejected under 35 USC §103(a) as being unpatentable over Richards et al. (US 6,950,485, hereinafter Richards) in view of Roberts (US 2006/0166619).

Claim 30 has been canceled, but as the features of claim 30 have been incorporated into claim 23, applicant provides herein reasoning as to why claim 23 is patentable over Richards in view of Roberts.

As discussed above, Richards fails to disclose or suggest all of the features of claim 23, namely "...wherein the control unit is additionally adapted to control the pulse generator and the first encoding unit to form the coded pulse group from a predetermined plurality of single pulses in dependence on the values of the random number sequence in such a way that the single pulses of one and the same pulse group overlap in time after the pulse formation," as taken from claim 30. The features of claim 30 that are now incorporated into independent claim 23 are similar to the features of independent claims 1 and 17 that applicant submits are patentable over Richards in view of Roberts. Roberts fails to disclose or suggest the features of claim 23 that are lacking in Richards, as discussed above with regard to claims 1 and 17. Thus, while claim 30 is canceled, applicant submits that claim 23 is also patentable over Richards in view of Roberts.

Allowable Subject Matter

At page 17 of the Office Action, the Office indicates that claims 3-4 and 27-29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant would like to express appreciation to the Office for the allowable claims. Applicants respectfully submit that claims 3-4 and 27-29 are allowable in their current form in view of the allowability of claims 1, 17 and 23 from which they ultimately depend.

CONCLUSION

For all the foregoing reasons it is believed that all of the claims of the application are in condition for allowance and their passage to issue is earnestly solicited.

Respectfully submitted,

2/1/11
Date

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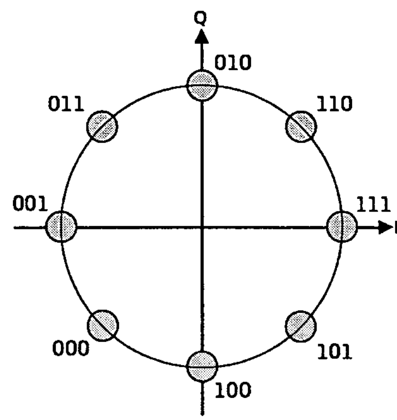
APPENDIX A

Constellation diagram

A **constellation diagram** is a representation of a signal modulated by a digital modulation scheme such as quadrature amplitude modulation or phase-shift keying. It displays the signal as a two-dimensional scatter diagram in the complex plane at symbol sampling instants. In a more abstract sense, it represents the possible symbols that may be selected by a given modulation scheme as points in the complex plane. Measured constellation diagrams can be used to recognize the type of interference and distortion in a signal.

By representing a transmitted symbol as a complex number and modulating a cosine and sine carrier signal with the real and imaginary parts (respectively), the symbol can be sent with two carriers on the same frequency. They are often referred to as *quadrature carriers*. A coherent detector is able to independently demodulate these carriers. This principle of using two independently modulated carriers is the foundation of quadrature modulation. In pure phase modulation, the phase of the modulating symbol is the phase of the carrier itself.



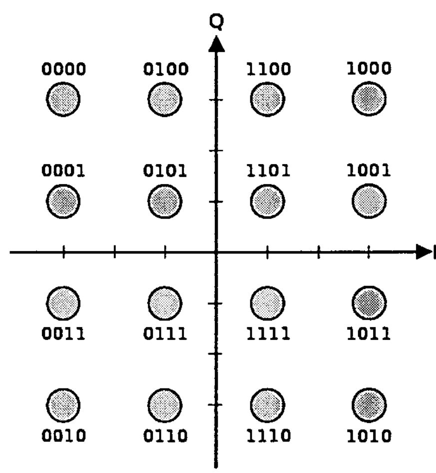
A constellation diagram for 8-PSK.

As the symbols are represented as complex numbers, they can be visualized as points on the complex plane. The real and imaginary axes are often called the *in phase*, or I-axis and the *quadrature*, or Q-axis. Plotting several symbols in a scatter diagram produces the constellation diagram. The points on a constellation diagram are called *constellation points*. They are a set of *modulation symbols* which comprise the *modulation alphabet*.

Also a diagram of the ideal positions, signal space diagram, in a modulation scheme can be called a constellation diagram. In this sense the constellation is not a scatter diagram but a representation of the scheme itself. The example shown here is for 8-PSK, which has also been given a Gray coded bit assignment.

Interpretation

Upon reception of the signal, the demodulator examines the received symbol, which may have been corrupted by the channel or the receiver (e.g. additive white Gaussian noise, distortion, phase noise or interference). It selects, as its estimate of what was actually transmitted, that point on the constellation diagram which is closest (in a Euclidean distance sense) to that of the received symbol. Thus it will demodulate incorrectly if the corruption has caused the received symbol to move closer to another constellation point than the one transmitted.



A constellation diagram for rectangular 16-QAM.

This is maximum likelihood detection. The constellation diagram allows a straightforward visualization of this process — imagine the received symbol as an arbitrary point in the I-Q plane and then decide that the transmitted symbol is whichever constellation point is closest to it.

For the purpose of analyzing received signal quality, some types of corruption are very evident in the constellation diagram. For example:

- Gaussian noise shows as fuzzy constellation points
- Non-coherent single frequency interference shows as circular constellation points

- Phase noise shows as rotationally spreading constellation points
- Attenuation causes the corner points to move towards the center

A constellation diagram visualises so similar phenomena as an eye pattern does for one-dimensional signals. The eye pattern can be used to see timing jitter in one dimension of modulation.

Article Sources and Contributors

Constellation diagram *Source*: http://en.wikipedia.org/w/index.php?oldid=384478568 *Contributors*: Alinja, Conti, DavidCary, Glenn, KSchutte, Lacbil, Leonardomio, Mazer, Michael Hardy, OlEnglish, Oli Filth, Rod57, Sakurambo, Sam8, Scls19fr, Splash, Whosasking, 24 anonymous edits

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